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DISPERSAL AND SURVIVAL OF SEED IN A PARTIALLY-CUT PONDEROSA PINE STAND

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Availability of seed for germination vitally affects natural regeneration in partially-cut ponderosa pine stands. How much seed will a given residual stand disperse in a good seed year? When is most of it dispersed? How much do rodents and other seed-destroying agents consume? Answers to these questions can be of considerable help to the forest manager in planning for successful regeneration.

To answer the questions presented, a study was initiated on the Bluesky Creek timber sale area on the Kootenai National Forest in 1948. Fortunately, the heavy ponderosa pine seed crop of that year provided a good basis for a preliminary report.

The area chosen for study was selectively logged in 1947. The composition and average stocking of the residual overstory (trees 10 inches d.b.h. and over) is shown below.

	No. per acre	Basal Area Sq.ft.	Volume Bd.ft.
Ponderosa pine	12.5	21.7	4760
Douglas-fir	14.5	14.5	1640
Western larch	2.0	4.4	660
Total	29.0	40.6	7060

1/ In cooperation with the Northern Rocky Mountain Forest and Range Experiment Station.

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METHOD

Five 1/4-milacre seed traps (3.3 feet square) were placed in each of four locations on August 5, 1948. Seed which fell into the traps were removed and counted from time to time. These data gave an estimate of how many seed actually reached the ground. They did not indicate how many may have been taken from the trees by birds and cone-gathering squirrels.

The amount of seed which was destroyed by rodents and other agents after it reached the ground was investigated in May, 1949. Leaves and other litter were removed from 1/4-milacre plots adjacent to each of the seed traps, and by a process of screening, a count of the sound seed was obtained. The differences between numbers of seed caught in the traps and numbers found on these unprotected plots represent the take by rodents and other agents.

RESULTS

Seed production

Ponderosa pine on the sample areas scattered seed from the 1948 crop at the rate of 104,000 per acre (table 1). Cutting tests indicated that 72.7 percent, or almost 76,000 per acre, were sound. Though figures for comparison are not available, observers agreed that the 1948 crop of ponderosa pine seed was greater than average.

Table 1.--Quantity of seed dispersed per acre and their soundness, 1948 crop 1/

Species	All seeds 2/	Soundness	Sound seeds
	Number	Percent	Number
Ponderosa pine	104,000	72.7	75,600
Douglas-fir	34,200	11.1	3,800
Western larch	11,000	20.0	2,200

1/ Basis, twenty 1/4-milacre seed traps.

2/ The standard error of the mean, in percent, is as follows: ponderosa pine, 11; Douglas-fir, 28; western larch, 19.

Time of dispersal

The fall of ponderosa pine seed peaked in September and was almost complete by the end of October (table 2). Maximum dispersal of Douglas-fir and western larch seed also occurred in September, but considerable proportions of these species fell at other times. Soundness of ponderosa pine seed varied with time of dispersal. Seventy-eight percent of that which fell in September was sound, as contrasted to 50 percent for that which fell at other times. This relationship was less apparent with western larch and not at all with Douglas-fir.

Table 2.--Time of seed dispersal, 1948 crop 1/

(Percent of total seeds dispersed)

Period	Ponderosa pine	Douglas-fir	Western larch
Aug. 5 to Sept. 7, 1948 (34 days)	9.4	12.9	12.7
Sept. 8 to Oct. 6, 1948 (29 days)	79.4	42.1	36.4
Oct. 7 to Oct. 29, 1948 (22 days)	4.8	7.0	18.2
Oct. 30,1948 to May 2,1949 (185 days)	5.4	18.1	27.3
May 3 to Aug. 1, 1949 (91 days)	1.0	19.9	5.4
Total	100.0	100.0	100.0

1/ Basis, twenty 1/4-milacre seed traps.

Seed losses

Ninety-two percent of the sound ponderosa pine seed disseminated before May 3, 1949, was destroyed by rodents and other agents, leaving only 5,800 sound seed per acre available for germination. 2/ Douglas-fir seed fared better, losing only 60 percent. Survival of western larch seed was not determined because of the small sampling base. Small mammal population counts and stomach content analyses which were made in the study area indicated that white-footed mice and chipmunks were the principal offenders in seed destruction. 3/

2/ Since this investigation had to be made before germination began in the spring, the survival of seed is based upon that which fell prior to May 3, 1949. However, 99 percent of the ponderosa pine and 80 percent of the Douglas-fir crop fell before May 3.

3/ Consumption of Ponderosa Pine Seed by Small Mammals, by Lowell Adams, Northern Rocky Mountain Forest and Range Experiment Station, Research Note No. 80, March 1950.

DISCUSSION

Although cutting tests showed 72.7 percent of the ponderosa pine seed to be sound, other observations indicated that actual germinability was much lower. Germination tests upon 1948 ponderosa pine seed gathered for the Savenac Nursery gave generally low germination--an average of only 13 percent. These collections came from widely scattered points in western Montana, including locations within the Kootenai National Forest. The Kootenai collection germinated at the rate of 8 percent. Only one exception to the generally low viability was reported. Seed gathered by a private collector near Eureka, Montana showed 68 percent viability. Seedling counts made in 1949 upon transects at the locations of the seed traps indicated that even on the best seedbed surface, bare mineral soil, seeds germinated at the rate of only 770 per acre. Although field counts of young seedlings are subject to error, due to total disappearance of some seedlings, the data tend to confirm the suspicion of low viability.

This study is being continued. With additional data of future years, findings will be strengthened and perhaps modified. Yet, the information from the heavy 1948 seed crop is sufficient to show rather conclusively that rodents and other agents can destroy the bulk of a ponderosa pine seed crop before the seed have a chance to germinate.

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